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**Original Research Article**

# Micronutrient supplementation in pregnancy: a KAP survey with healthcare consultants in India

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## ABSTRACT

**Background:** Maternal nutrition during pregnancy is a serious public health issue as it negatively impacts women and their children. The most commonly used nutritional interventions during pregnancy are folic acid and omega-3 fatty acid (n-3 FA). This survey aimed to evaluate the knowledge, attitude and perception towards folic acid, n-3 FA and other supplementation amongst healthcare practitioners (HCPs).
**Methods:** A close-ended questionnaire-based survey was distributed among obstetricians-gynaecologists and HCPs overlooking pregnant and lactating women between July and September 2022 in India. An excel based survey analysis was performed once the survey completed.
**Results:** A total of 500 valid questionnaires were collected. Only 55% of them recommended n-3 FA, whereas 45% did not recommend as they believed that the typical Indian diet provides enough n-3 FA and supplements are not necessary. The majority (58.91%) of prescribers prescribed n-3 FA to all pregnant women, followed by older women with a history of abortion and high-risk pregnancy. Both eicosapentaenoic acid and docosahexaenoic acid were favoured in clinical practice. In addition, 56.8% of HCPs recommended folic acid at a dose of 5 mg/day for patients with a bad obstetric history, while 43.2% of HCPs recommended folic acid at a dose of 1 mg/day.
**Conclusions:** Supplements and adequate nutrition can reduce the likelihood of poor maternal and foetal outcomes in high-risk pregnancies. Nutritional supplementation is a cost-effective and safe risk-reduction method, given the high prevalence of pregnancy complications. However, more knowledge dissemination on n-3 FA supplements, folic acid and micronutrients is essential.

**Keywords:** Micronutrient supplementation, Pregnancy, Folic acid, KAP

## INTRODUCTION

Poor maternal nutrition throughout pregnancy is a serious public health concern as it has negative consequences on women and their offspring. Preterm deliveries, small-for-gestational-age (SGA) births, neural tube defects (NTDs) and maternal morbidity are all increased due to maternal malnutrition. Poor diet during pregnancy increases the risk of cardiometabolic disorders in children later in life.[9] According to the global burden of disease study, poor diet contributed 11 million deaths in 2017, more than any other risk factor. Three million of these deaths were linked to high sodium intake and lack of whole grains, while 2 million deaths were due to a lack of fruit intake. Hence, the maternal dietary intake during pregnancy needs to be

adequate to meet the increased nutritional demands, maintain metabolism and support foetal growth.[1]

One of the most commonly used nutritional interventions during pregnancy is maternal folic acid supplementation.[2] The Indian council of medical research-National institute of nutrition (ICMR-NIN) recommends an iron folate supplementation dose of 570 µg/d in pregnant women and 330 µg/d in lactating women.[12] The impact on foetal development and neural tube formation has been extensively studied as a lack of folate during pregnancy and at conception. In addition, it is suggested that maternal folate insufficiency affects offspring's neurodevelopment and brain health, perhaps leading to neurodevelopmental disorders and disabilities such as autism spectrum disorders and schizophrenia.[10] The long-chain polyunsaturated fatty acids (LCPUFAs) such as docosahexaenoic acid (DHA), present in higher concentrations in the brain and the central nervous system, are crucial for the growing foetus's neurological, visual and cognitive development. DHA consumption is crucial throughout pregnancy, and pregnant women should be provided with adequate DHA education during gestation. After the first trimester, when the neural tube has closed and grey matter is formed, DHA begins to quickly accumulate in the brain. This accumulation may last for 2 years.[1-3] Eicosapentaenoic acid (EPA) is another LCPUFA that contributes many beneficial health effects, including foetal and infant development and maternal health. The Institute of Medicine (IOM) recommends that the intake of EPA and DHA contributes to 10% of the total omega-3 fatty acid (n-3 FA) intake (i.e., 160 mg per day approximately).[4] As the foetus draws what it needs from maternal reserves, some studies indicate that insufficient DHA intake is associated with lower maternal DHA status. In addition, DHA supplementation can boost the expression of proteins that transport fatty acids through the placenta, benefiting both the mother's and the foetus's fatty acid status.[1-2] This survey was aimed to determine the knowledge, attitude and perception (KAP) towards folic acid, n-3 FA and other supplementation in pregnancy among the healthcare practitioners (HCPs) looking into obstetrics-gynaecology; obstetricians-gynaecologists (Ob-Gyn) and HCPs overlooking pregnant and lactating women.

## METHODS

A quantitative, close-ended, questionnaire-based survey was conducted in India between July 2022 and September 2022. A structured questionnaire was created after a thorough literature review. The questionnaire was divided into two sections; it included items related to understanding of HCPs and items assessing KAP regarding the use of DHA, folic acid and iron supplements among pregnant and lactating women in India. The survey questionnaire content validation was done by a panel of four experts in the field. The survey questionnaire was administered online to 2,000 Ob-Gyn and HCPs overlooking pregnant and lactating women through an online link. HCPs who were not responding to emails were contacted telephonically. Before the survey, an E-consent was obtained from all the HCPs. The survey responses were collated, and excel based analysis was done.

## RESULTS

The survey was conducted between July 2022 and September 2022. A total of 500 healthcare professionals completed the survey. The specialty of the physician is mentioned in (Figure 1).

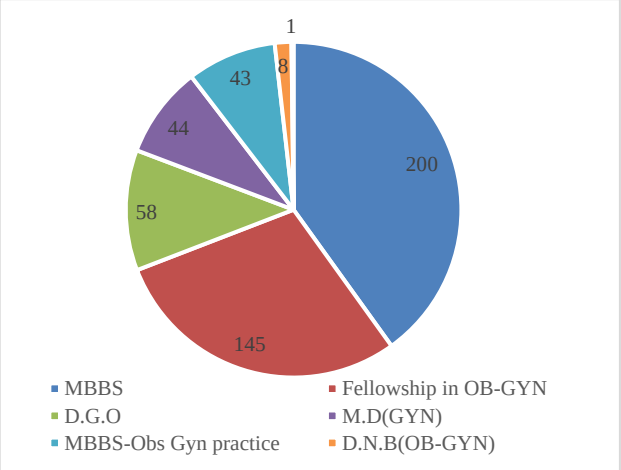


**Figure 1: Physician specialty.**

In the survey, the HCPs were asked to share their opinion on two statements (refer to supplement). 88.9% of HCPs believed that n-3 FAs are needed to improve pregnancy and foetal outcomes, while 90.6% of HCPs considered that supplementation of DHA can lead to better pregnancy outcomes in pre-eclampsia or eclampsia or H/O intrauterine growth restriction (IUGR). The practice of prescribing supplementation to pregnant and lactating women. In pregnancy and lactation, 55% of HCPs prescribed n-3 FA supplements; however, 45% of HCPs did not prescribe. Out of these non-prescribers, 56% of HCPs believed that the Indian diet is sufficient to provide the necessary n-3 FA, while 52.89% of HCPs responded that these supplements are not necessary or beneficial during pregnancy and lactation. Moreover, 44.89% of HCPs did not prescribe n-3 FA supplements for their unpleasant taste and fishy breath, while only 16.44% of HCPs did not prescribe these supplements due to their high cost. Poor diet during pregnancy has been linked to unfavourable pregnancy outcomes, which raise the risk of cardiometabolic disorders in children later in life. Throughout their reproductive years, many women experience concurrent deficits of vital micronutrients, such as iodine, iron, zinc, vitamin B12, vitamin D and other micronutrients. According to surveys conducted by the National nutrition monitoring bureau (NNMB) in 10 Indian states, most rural diets consist primarily of cereals and millet, and only about half of pregnant women

consume enough protein and energy. The NNMB also revealed that most pregnant women were not consuming enough folic acid, iron or vitamins. A study concluded that nutritious diets were unaffordable by ~65%–75% of households. Due to a lack of resources, women did not consume the required diets. Higher parity was associated with lower consumption of special foods such as milk, animal protein, pulses and fruits during pregnancy and was associated with lower diet diversity. In continuation for non-prescribing, the most common reason quoted was the non-availability of appropriate guidelines on the same. India has very few nationally representative data and guidelines on maternal nutrition. The most recent National Family Health Survey (NFHS) data collected dietary information using food frequency questions that did not include sufficient food groups to calculate maternal dietary diversity and macronutrient or micronutrient intakes. The world health organization (WHO) does offer standards for antenatal care, but comprehensive guidelines detailing woman's nutritional requirements from conception through pregnancy and lactation are still lacking. Guidelines should include micronutrient supplement formulations, locally adapted food supplements, the required number of counselling sessions, recommendations on diet and the management of special dietary requirements for at-risk groups of pregnant women, including overweight and obese pregnant women. 73.78% of HCPs reported that they do not prescribe n-3 FA to pregnant women as there are no appropriate guideline recommendations on the same, 15.11% reported that they are not updated about recent scientific data on n-3 FA and 45.33% reported that they would like to know more about n-3 FA.

### *Patient profile*

55% of HCPs who prescribed n-3 FA in various patient profiles are depicted in (Figure 2).

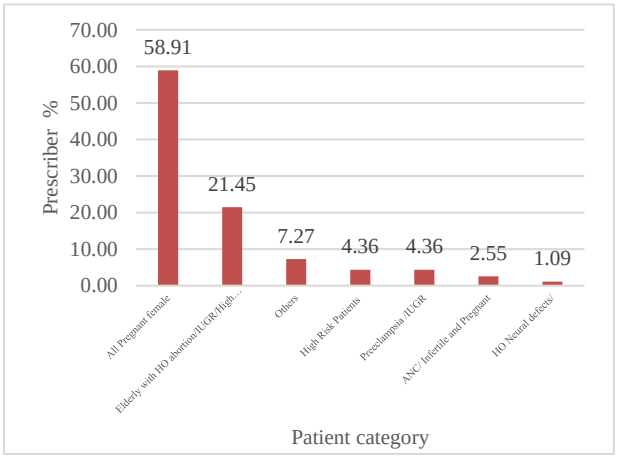


**Figure 2: Patient profile in which n-3 FA supplements are prescribed.**

Moreover, 58.91% of HCPs prescribed n-3 FA to all pregnant women, while 21.45% HCPs prescribed to elderly females with a history of abortion/IUGR/high risk/infertility.

### *Usage of supplements*

HCPs reported that both EPA and DHA are preferred in clinical practice. Moreover, 38.55% of HCPs preferred EPA, 32.36% of HCPs preferred DHA and 29.09% of HCPs preferred a combination of both (Figure 3). In addition, 32.36% of HCPs prescribed during the first trimester, 58.55% of HCPs prescribed during the second trimester, 34.18% of HCPs prescribed during the third trimester and 23.64% of HCPs prescribed during lactation. Moreover, 49.82% of HCPs prescribed DHA at a dose of 400 mg, followed by 200 mg (33.45%); 600 mg (13.82%).

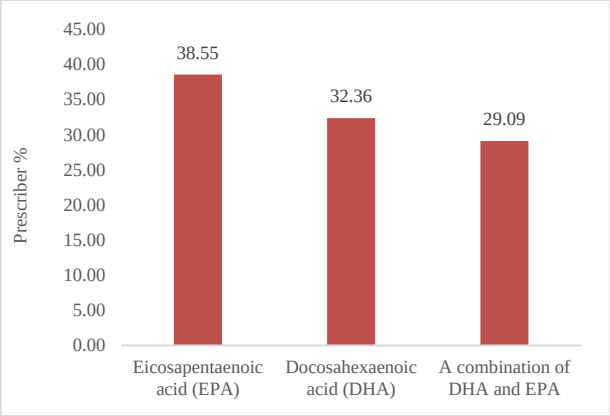


**Figure 3: Preference for n-3 FA by HCPs.**

In patients with bad obstetric history (BOH), 56.8% of HCPs prescribed folic acid at a dose of 5 mg/day and 43.2% prescribed it at a dose of 1 mg/day. The HCPs were enquired about the significance of prescribing the bioavailable form, L-methyl folate/methyltetrahydrofolate. 56.2% of HCPs reported that it is an option to avoid blood folate deficiencies due to genetic polymorphism that impairs the conversion of supplemental and 44.6% of HCPs considered that there is no significant difference between conventional and bioavailable forms. The other reasons are represented in Figure 4. Sufficient levels of a micronutrient can be achieved when supplemented in its bioavailable form. Nearly 40% to 60% of individuals have genetic polymorphisms that prevent the body from converting supplemental folic acid to L-methyl folate, which is folic acid's active form. Through a sequence of biochemical reactions, the body transforms dietary folic acid into L-methyl folate, and the enzyme methyltetrahydrofolate reductase (MTHFR) completes the process in its final phase. Certain polymorphisms result in insufficient MTHFR activity. Hence, L-methyl folate supplementation may be the most effective way to prevent blood folate deficits due to the high prevalence of these genetic polymorphisms. Testing every woman to discover if she possesses the necessary polymorphisms is impractical. Therefore, it is recommended to give L-methyl folate-containing prenatal vitamins to women with

a family history of NTDs or premature births rather than folic acid.

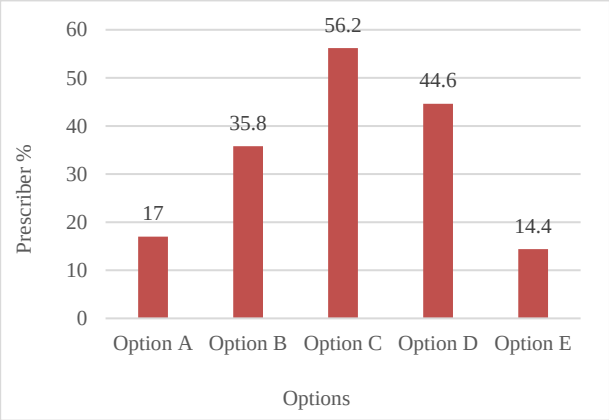


**Figure 4: Significance of prescribing the bioavailable form, L-methyl folate/methyltetrahydrofolate; A) This bioavailable form ensures adequate levels of folate, B) This form is beneficial in those with a family history of NTDs or preterm births, C) This form is an option to avoid blood folate deficiencies due to genetic polymorphism that impairs the conversion of supplemental, D) There is no significant difference between conventional and bioavailable forms, E) I would like to know more about the bioactive form.**

Preliminary research also suggests that L-methyl folate may help to prevent postpartum anaemia. Total 83% of HCPs reported that they prefer to include nutritional supplements containing micronutrients, with 59.6% specifying the combinations and the remaining 23.40% were unable to specify the combinations. For pregnant women, 17% of HCPs did not prefer any specific combination of nutritional supplements containing all micronutrients represented in (Figure 5).

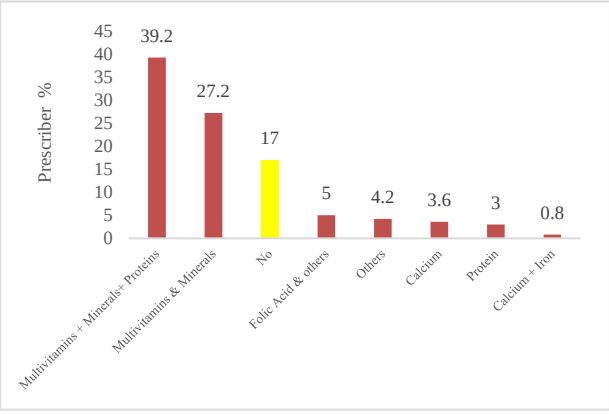


**Figure 5: Combination of nutritional supplements prescribed.**

***Educating patients***

All the HCPs reported that it is important to communicate the importance of folic acid, DHA and other nutrients to patients. A total of 92.8% HCPs reported that they communicate with their patient by counselling/verbally. To enhance nutrition, a woman and her family members can make decisions and act with the aid of maternal nutrition counselling. This includes choices and actions on the kinds, variety and quantities of food to eat to meet dietary demands and the consumption of dietary supplements. To maintain good health and avoid gaining too much weight during pregnancy, counselling about eating well and being active needs to be provided in all situations, which would lead to significant improvement in dietary modification. However, the delivery of counselling should be non-judgmental and focused on the needs of women.

## DISCUSSION

A healthy diet and adequate nutritional supplements ensure proper foetal growth, maternal health and lactation; still, there are no specific guidelines recommending the appropriate dosage and supplements required during pregnancy and lactation. The major finding of the survey is that only 55% of HCPs recommend supplements to pregnant and lactating women despite the available evidence on the importance of supplements in pregnancy. They opined that dietary intake meets the requirement of n-3 FA, and supplements are not much beneficial during pregnancy and lactation. Moreover, negative pregnancy outcomes were linked to poor eating throughout pregnancy, which emphasises the need for tracking of the dietary pattern of pregnant women and counselling them to implement the high-quality diet. The timing and duration of supplementation are significant variables affecting the impact of n-3 FA on the risk of preterm delivery. Given that the mechanism of action of n-3 FA is linked to inflammation and myometrium's electrical activity, it is reasonable to assume that both short-term (acute) and long-term (during pregnancy) supplements have various impacts on preterm delivery outcomes. In our survey, the majority of HCPs prescribed DHA during the second trimester (35. 27%), followed by the first (21.82%) and third (13.82%) trimesters. In addition, 10.91% of HCPs reported that they prescribe from second trimester till the lactation period. Only 6.8% of healthcare professionals prescribed DHA during all three trimesters along with the lactation period. Data suggest that each trimester requires DHA; the brain and spinal cord are developing in the first trimester, there is rapid neural and retinal development in the second trimester and the third trimester is critical as the foetus's brain is growing rapidly, basically every day, during this time. Therefore, it is imperative to start with DHA supplementation from the first trimester and up to 18 months of life.[6-8] The majority of HCPs prescribe a dose of 400 mg followed by 200 mg.[5] A survey conducted in the USA from 2003–2014 to evaluate the n-3 FA intake concluded that the estimated intakes of n-3 FA in pregnant women did not differ from non-pregnant women (100.6 versus 92.7 mg EPA+DHA in pregnant versus non-pregnant women aged 20–44 years). The estimated EPA+DHA intake by pregnant women is

less than one-fifth of the required 520 mg/day of EPA+DHA for pregnant and lactating women, as recommended by the Workshop on the Essentiality of and Recommended Dietary Intakes recommendations.[6] The evidence suggests that improving periconceptional folate status reduces the risk of neonatal NTDs. Thus, increased folate intake is recommended before and during the early stages of pregnancy through folic acid supplements or fortified foods. A cross-sectional study conducted on 417 pregnant women showed that about 48.4% of women took folic acid supplements at various stages of pregnancy; however, only 1.92% of women did so during the period that protects against neural tube abnormalities. The use of folic acid for the prevention of neural tube abnormalities was substantially correlated with age, the early timing of antenatal registration, the consultation of a preconception, past unsuccessful pregnancies and the level of folic acid awareness. The study concludes the need to improve the usage of folic acid at a protective period against NTDs and other congenital anomalies.[12] In our survey, it is prescribed in patients with BOH at a dose of 5 mg/day by >50% of doctors. In addition, healthcare professionals mentioned that there is no significant difference between bioavailable and conventional forms; however, bioavailable forms are preferred to avoid blood folate deficiencies due to genetic polymorphism that impairs the conversion of supplements.[7] Also, it has an additional advantage; it is well-absorbed even with changing gastric pH, while metabolic disorders have a little impact on its bioavailability. By replacing folic acid with 5-MTHF, metabolic defects brought on by methylenetetrahydro-folate reductase polymorphism are overcome, interactions with medications that inhibit dihydrofolate reductase are minimised and the risk of masking haematological symptoms of vitamin B12 deficiency is decreased. Additionally, 5-MTHF usage guards against any potential negatives of unconverted folic acid in the peripheral circulation.[11] Education is a crucial part of prenatal care, but previous research has shown that women anticipate getting more nutrition advice from their doctor, midwife, or other healthcare than they do.[8] In our survey, healthcare professionals confirmed that they communicate the importance of nutrients via counselling, diet chart, videos and handouts. Nevertheless, this survey provides encouraging results to disseminate the importance of supplements in pregnancy and increase the use of DHA consumption in pregnant women and shows the need for appropriate guidelines for prescribing the supplements.

## CONCLUSION

The survey concludes that most HCPs understand the need for n-3 FA along with the daily dose needed for pregnant and lactating women. Pregnant women should be advised to concentrate on eating a balanced diet and finding reliable sources of specific nutrients. In high-risk pregnancies, the incidence of poor maternal and foetal outcomes can be decreased by supplements and adequate nutrition. Given the high prevalence of pregnancy complications, nutritional supplementation is a risk-reduction strategy that is both safe and affordable. However, more knowledge dissemination on n-3 FA supplements, folic acid and its active form and micronutrients is required along with strengthening antenatal care and empowering pregnant women through counselling.

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*Conflict of interest: Dr. Sunita Chandra, Dr. Sheela V Mane, Dr. Parag Biniwale and Dr. M. Tripura Sundari received remuneration from Insignia Communications during the conduct of the study. Dr. Anuradha Mulye and Dr. Charles Adhav are employees of Pfizer Ltd.*
*Ethical approval: Not required*

## REFERENCES

1. Massari M, Novielli C, Mandò C, Di Francesco S, Della Porta M, Cazzola R, et al. Multiple micronutrients and docosahexaenoic acid supplementation during pregnancy: A randomized controlled study. Nutrients. 2020;12(8):2432.
2. Silva C, Keating E, Pinto E. The impact of folic acid supplementation on gestational and long term health: Critical temporal windows, benefits and risks. Porto Biomed J. 2017;2(6):315-32.
3. Emmett R, Akkersdyk S, Yeatman H, Meyer BJ. Expanding awareness of docosahexaenoic acid during pregnancy. Nutrients. 2013;5(4):1098-109.
4. Serra R, Peñailillo R, Monteiro LJ, Monckeberg M, Peña M, Moyano L, et al. Supplementation of omega 3 during pregnancy and the risk of preterm birth: A systematic review and meta-analysis. Nutrients. 2021; 13(5):1704.
5. Thompson M, Hein N, Hanson C, Smith LM, Anderson-Berry A, Richter CK, et al. Omega-3 fatty acid intake by age, gender, and pregnancy status in the United States: National Health and Nutrition Examination Survey 2003-2014. Nutrients. 2019; 11(1):177.
6. Greenberg JA, Bell SJ. Multivitamin supplementation during pregnancy: Emphasis on folic acid and l-methylfolate. Rev Obstet Gynecol. 2011;4(4):126-7.
7. Emmett R, Akkersdyk S, Yeatman H, Meyer BJ. Expanding awareness of docosahexaenoic acid during pregnancy. Nutrients. 2013;5(4):1098-109.
8. Nguyen PH, Kachwaha S, Tran LM, Sanghvi T, Ghosh S, Kulkarni B, et al. Maternal diets in India: Gaps, barriers, and opportunities. Nutrients. 2021;13(10): 3534.

9. Naninck EFG, Stijger PC, Brouwer-Brolsma EM. The importance of maternal folate status for brain development and function of offspring. Adv Nutr. 2019;10(3):502-19.
10. Scaglione F, Panzavolta G. Folate, folic acid and 5-methyltetrahydrofolate are not the same thing. Xenobiotica. 2014;44(5):480-8.
11. Dessie MA, Zeleke EG, Workie SB, Berihun AW. Folic acid usage and associated factors in the prevention of neural tube defects among pregnant women in Ethiopia: Cross-sectional study. BMC Preg Childbirth. 2017;17(1).
12. Sayyed A. Nutrient requirements for Indians-ICMR-NIN, 2020. Available at: https://www.metabolichealthdigest.com/nutrient-requirements-for-indians-icmr-nin-2020/. Accessed on 20 November 2021.
13. Marshall NE, Abrams B, Barbour LA, Catalano P, Christian P, Friedman JE, et al. The importance of nutrition in pregnancy and lactation: Lifelong consequences. Am J Obstet Gynecol. 2022;226(5):607-32.

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## ANNEXURE

### Survey Questionnaire

**1. Do you prescribe omega-3 fatty acid supplements to pregnant and/or lactating women in your practice? (If YES, go to Q4 - question; if NO, specify)**
a. Yes
b. No

**2. If NO, specify (Kindly tick all that are applicable)**
a. Omega-3 fatty acid supplements are not much beneficial during pregnancy and lactation
b. Dietary intake provides the requirement of omega-3 fatty acids
c. Unpleasant taste and fishy breath with supplements, make the patient discontinue
d. Omega-3 fatty acid supplements are costly

**3. You do not prescribe omega-3 fatty acids in pregnancy (Kindly tick all that are applicable)**
a. Not updated about recent scientific data
b. There are no appropriate guideline recommendations for omega-3 fatty acid supplementation
c. Would like to understand more about omega-3 fatty acids

**4. To which patients do you advise omega-3 fatty acid supplementation during pregnancy and lactation? (Name the profiles) (Not applicable if you have answered "NO" to Q1)**

**5. Which omega-3 fatty acid do you prefer to prescribe? (Not applicable if you have answered "NO" to Q1)**
a. Docosahexaenoic acid (DHA)
b. Eicosapentaenoic acid (EPA)
c. A combination of DHA and EPA

**6. When do you prescribe docosahexaenoic acid (DHA) supplements? (Not applicable if you have answered "NO" to Q1) (Select all that are applicable)**
a. First-trimester
b. Third-trimester
c. Third-trimester
d. Lactation

**7. Apart from dietary advice, what is the dose of docosahexaenoic acid (DHA) you prescribe? (If you prescribe any other dose please mention) (Not applicable if you have answered "NO" to Q1)**
a. 200 mg
b. 400 mg
c. 600 mg
d. Any other dose _____

**8. In patients with bad obstetric history (BOH), what dose of folic acid supplementation do you prescribe?**
a. 1 mg/day
b. 5 mg/day
Why do you prescribe this dose and for how long? _____

**9. What is the significance of prescribing the bioavailable form, L-methyl folate/methyltetrahydrofolate? (Kindly tick all that are applicable)**
a. This bioavailable form ensures adequate levels of folate
b. Beneficial in those with a family history of neural tube defects (NTDs) or preterm births
c. An option to avoid blood folate deficiencies due to genetic polymorphism that impairs the conversion of supplemental folic acid to its active form
d. No significant difference in conventional and bioavailable form
e. I would like to know more about the bioactive form

**10. Do you prescribe any specific combination of nutritional supplements with all the micronutrients in pregnant women?**
Response _____

**11. How do you communicate the importance, of folic acid, DHA, and other nutrients to patients, and what would help you to better convey the same to patients?**
Response _____